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# Growing Cauliflower and Broccoli

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UNITED STATES  
DEPARTMENT OF  
AGRICULTURE

FARMERS'  
BULLETIN  
NUMBER 2239

PREPARED BY  
SCIENCE AND  
EDUCATION  
ADMINISTRATION

On January 24, 1978, four USDA agencies—Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), and the National Agricultural Library (NAL)—merged to become a new organization, the Science and Education Administration (SEA), U.S. Department of Agriculture.

This publication was prepared by the Science and Education Administration's Federal Research staff, which was formerly the Agricultural Research Service.

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The pesticides mentioned in this publication were federally registered for the use indicated as of the issue of this publication. The user is cautioned to determine the directions on the label or labeling prior to use of the pesticide.

# GROWING CAULIFLOWER AND BROCCOLI

Cauliflower and broccoli are popular members of the cabbage family.

There are two types of broccoli—heading and sprouting. The curd (head) of heading broccoli is white and compact, like cauliflower. Heading broccoli takes longer to mature than cauliflower, however. Sprouting broccoli has green heads that are branched, rather than compact.

In this publication “cauliflower” refers to both cauliflower and heading broccoli; “broccoli” refers only to sprouting broccoli.

## GENERAL NEEDS AND ADAPTATION

Cauliflower is difficult to grow. It needs—

- fertile, moist soil, rich in organic matter and nitrogen;
- good drainage;
- a cool, humid climate; and
- a frost-free growing season.

Cauliflower grown on light soil must be kept well watered.

Because its needs are so precise, cauliflower is grown in only a few areas, chiefly on Long Island and in western New York, in Texas, in the Colorado mountains, and on the Washington and California coasts. Small amounts are grown elsewhere.

Broccoli's requirements are similar to those of cauliflower, but it is not as exacting and thus can be grown in a much wider area. Much of the broccoli grown in the Southern and South Atlantic States is shipped to northern markets, fresh or frozen.

Because frozen broccoli keeps well in storage, it can be shipped long distances. This has opened up new markets.

## VARIETIES

### Cauliflower

Cauliflower varieties are not well defined. Strains within a variety differ in plant size, in foliage, and in how the inner leaves protect the developing curd from discoloration by sunlight. Poor strains are apt to develop small leaves that extend through the curd, lowering market value.

To make sure you get a good strain, buy high-grade seed from a reputable dealer. Good yields more than make up for the extra expense of good seed.

Here are descriptions of some typically good varieties, from earliest to latest:

*Early Snowball* does well in areas

with a short growing season. It matures in 50 to 60 days after transplanting and is the most important short-season variety. Plants are dwarf, compact, and fast growing. The leaves are medium green and grow upright, turning outward at the tips. The curd is uniform, solid, and ivory white. It has excellent flavor and quality.

*Super Snowball* is good for canning or freezing. It matures in 55 to 60 days. The plants are dwarf and the leaves are blue green, long, and spreading. The curd is solid and white.

*Snowdrift* is large and vigorous. The curd is large, free of leaflets, and well protected by the inner leaves during its early development. It matures in 60 to 65 days.

*Danish Giant*, also called *Dry Weather*, grows well in drier climates. It is grown mainly in the Midwestern States. The curd is white and large, averaging about 7 inches across. It matures in 70 to 80 days.

*Imperial 19-6* is an ideal variety for growers who prefer maturity over a relatively short period. A large percentage of the heads may be harvested at one time. Plants are vigorous and have large jacket leaves to cover the head.

*Self-Blanche* is a unique variety with wrapper leaves that curl over the heads when grown in cool temperatures. Under the right conditions, heads of 7 to 8 inches may be well covered without tying. Heads are late maturing, solid, and fine textured.

*Snow King* is an extremely early  $F_1$  hybrid that matures about 55 days after setting plants. It makes vigorous growth, stands heat very well, and produces heads over 2

pounds. It is ideal for home and market gardeners.

*Snow Crown* is an  $F_1$  hybrid of the true Snowball type. It is early maturing and uniform so that it can be tied and cut practically all at one time. Heads are smooth, pure white, and of good depth.

Winter cauliflowers take up to 150 days to mature. They are grown mainly on the California coast, where the growing season is very long. Varieties are available for planting on definite dates from June to November for harvest from November to May. Some of the best, from the earliest to the latest, are: *Early Pearl*, *Christmas*, *February*, *March*, *St. Valentine*, and *Late Pearl*. Names of the varieties reflect the harvest dates.

## Broccoli

Most American-grown broccoli is of the Italian Green type called Calabrese (fig. 1).

New varieties are being developed to meet increasing demands. Some are especially adapted to specific areas. Others are suited for freezing.

Here are some of the popular varieties:

*Atlantic* can be planted densely for a high per-acre yield. Plants are dwarf and compact, with fast-developing heads that are medium to large, round, and compact. It is a distinctive short-season type suited for a fall harvest in the Northeastern Atlantic Coast States.

*Coastal* is an early variety grown in the Far West. Plants are very short and compact. There is little division among clusters in the head. The buds are small, with a good, lasting color.



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Figure 1.—Head of broccoli ready for harvest.

Since the heads are rather uniform, they can be harvested in only three or four cuttings.

*DeCicco* is a popular early Calabrese variety. It is very productive, with many side shoots that are good for freezing. Plants are light green and medium tall. It will grow in spring, summer, and fall.

*Green Sprouting Medium* is an important shipping and freezing variety. It is a midseason Calabrese, grown mainly on the Pacific coast and in the Southwest. It is too late for the Northern and Eastern States. Plants are large and vigorous, with large, compact central heads and a heavy yield of side heads after central heads are harvested.

*Green Sprouting Late*, a long-

season Calabrese, is grown mainly in California for early spring harvest. It would probably grow well in the South Atlantic States, too, but it is not grown there at present.

*Waltham 29* can be grown in many regions, but is particularly suited for the Northeastern and Atlantic Coast States for fall harvesting.

It produces over a moderate-long season and is generally blue-green and fairly uniform. Plants are stocky with large, broad central heads. They develop many side heads that are good for freezing. Hybrid broccoli is now being developed and is gaining in importance where commercial operations require once over mechanical harvesting.

*Spartan Early* is a compact type



that has uniform plants and matures quite early. It is especially adapted for spring and summer crops. Lateral shoots are smaller and mature later than the central head.

*Green Comet* is an  $F_1$  hybrid that is extra early with harvest in approximately 40 days from setting plants. It makes vigorous growth and has resistance to heat. It is a single-head type with few side shoots.

## FERTILIZING

Cauliflower and broccoli need fertile soil for good yields. Soil can be made fertile by using fertilizer.

Before applying fertilizer and lime have your soil tested for phosphorus, potassium, acidity, and soil type. Soil tests for fertilizer recommendations are made by State rather than Federal agencies in all States except California and Illinois. In these two States, as well as in the others, commercial laboratories provide this service. Most States charge for testing soils. Consult your county agricultural agent or the soil specialist at your State agricultural college for soil tests.

Without a soil test, here is an example of what one acre of loamy soil might require:

- 1,000 pounds of a 10-10-10 fertilizer plowed down with the stubble.
- 50 pounds of ammonium nitrate or 100 pounds of nitrate of soda as a side-dressing about 2 weeks after plants have recovered from transplanting shock.

A second side-dressing about 2 weeks before the head is harvested.

For maximum cauliflower and broccoli growth, the following is recommended:

- Grow a well-fertilized green-manure crop. About 30 percent of the nitrogen used on the green-manure crop will be recovered by the succeeding cauliflower and broccoli crop.

- When using fertilizer high in phosphorus, place it in bands near the seed to decrease phosphorus fixation by the soil. Plow down the nitrogen and potassium fertilizer to speed the decomposition of plant residues.

- Use about a pint of starter solution of 5 pounds of 5-20-10 fertilizer per 100 gallons of water on each transplant, or use commercial fertilizer starter solution according to manufacturer's instructions.

Nitrogen deficiency can cause "buttons"—small, premature heads—particularly in cauliflower. Lack of water or poor drainage can also cause buttons. In addition, yellowing leaves indicate deficiency of nitrogen and a need to side-dress with nitrogen.

Discolored, pithy cores are a sign of boron deficiency. Discolored, deformed curds appear in cauliflower. In broccoli, an early symptom is browning of the florets.

In both manganese and magnesium deficiencies, the older leaves lose their green color, except for the veins.

If these symptoms appear, consult your county agricultural agent or the soil specialist at your State agricultural college.

## CONTROLLING WEEDS

Effective weed control is necessary to produce good quality cauliflower and broccoli. Herbicides are useful where mechanical cultivation supplemented by hand weeding is ineffective or impractical.

The same herbicides at the same rates may be used on cauliflower and broccoli. The following is a choice of herbicides for use on:

### *Seeded Plants*

- Trifluralin (*a,a,a*- trifluoro-2,6-dinitro-*N,N*- dipropyl-*p*-toluidine) at a rate of 3/4 pound active ingredient per acre before seeding.

- DCPA (dimethyl tet-rachloroterephthalate) at a rate of 10 pounds active ingredient per acre, before emergence of seedlings.

- Nitrofen (2,4-dichlorophenyl *p*-nitrophenyl ether) at a rate of 4 to 6 pounds active ingredient per acre, before or after emergence of seedlings.

### *Transplanted Plants*

- Trifluralin at a rate of 3/4 pound active ingredient per acre, before planting.

- Nitralin (4-(methylsulfonyl)-2,6-dinitro-*N,N*- dipropylaniline) at a rate of 3/4 to 1-1/2 pounds active ingredient per acre before or after planting.

- DCPA at a rate of 10 pounds active ingredient per acre, after planting.

- Nitrofen at a rate of 4 to 6 pounds active ingredient per acre, after planting.

Using a rototiller or a disk, incorporate trifluralin and nitralin into the soil to a depth of 2 to 3 inches.

DCPA needs moisture for best results. If it does not rain within a week after application, irrigate the soil with 1/2 to 3/4 inches of water.

Wait 2 weeks after plants are set or after seedlings appear before applying

nitrofen. Nitrofen is not effective unless weeds are small.

Use lower rates of application on sandy soils.

## **STARTING THE PLANTS**

When to plant cauliflower and broccoli depends on the area, how long the variety takes to mature, and when you plan to harvest.

Cauliflower and broccoli can be planted from mid-April to late fall in California for a long harvest, but in the Eastern States they must be planted in time for a summer or fall harvest.

In most of California, mild climate permits growing all seedlings in open beds for transplanting to the field. Elsewhere, this is done for summer and fall crops only, and plants for spring harvest must be started in hot-beds or greenhouses. Seedlings need a loose, easily pulverized loam that is not too fertile. Avoid soil that tends to crust on top.

If plants are started in open beds, plant the seed thinly in rows 12 to 14 inches apart. It is best to use a seeder. If the seed is broadcast, weed control is difficult. Cover lightly with one-quarter to one-half inch of soil.

If you start plants under glass, you may sow the seed in rows or broadcast. Sow thinly so seedlings have room to develop. Thin when they reach the four-leaf stage; allow 2 inches between plants. Leave them to grow until field conditions permit transplanting.

With proper handling, 3 to 4 ounces of seed will produce enough seedlings to plant 1 acre; 1 ounce of seed will produce about 3,000 plants.

If beds or flats have been used for

other plants in the cabbage family, be sure they are free of clubroot, black-leg, black rot, ring spot, and damping-off. These diseases can remain in the soil. (See Seedbed sanitation, p.14 )

If weather permits, either cauliflower or broccoli may be started in the field. Set the seeder to drop three or four seeds in one place. Be sure to thin early to avoid overcrowding.

## **TRANSPLANTING TO THE FIELD**

Plants are usually transplanted by hand for small plantings and by plant-setting equipment for large plantings.

Set plants in rows 2-1/2 to 3 feet apart. Distances between plants in rows vary from 15 to 36 inches, depending on the variety and strain. In the West, plants are usually spaced rather widely.

Do not set plants until danger of frost is past. In cauliflower, cold causes stunting and premature heading. Broccoli is less sensitive than cauliflower, but it can be damaged by frost.

Avoid planting cauliflower or broccoli in fields planted in cabbage, turnips, kale, or similar crops during the previous 4 to 5 years. All are susceptible to damage by the same diseases and insects.

As the plants grow, cultivate shallowly for weed control or for mulching. Deep cultivation causes root injury, especially late in the season.

Cauliflower needs a lot of moisture for a good yield. Most western growers irrigate. Some eastern growers rely on rainfall, and their crops are often injured by drought.

Broccoli will grow well under drier conditions than cauliflower.

## **BLANCHING CAULIFLOWER**

Exposure to sunlight discolors the cauliflower curd and can produce off-flavors. While curds are still small, the inner leaves protect them from sunlight. But as the curds grow, in most varieties, they force the inner leaves apart.

Some large, late varieties have very long, upright leaves which protect the curd until it is ready for harvest. Other varieties, like the Snowball types, must be blanched—that is, tied for protection.

To blanch, gather the longest leaves together over the curd and tie them with soft twine, raffia, or tape (fig. 2). Since the plants grow and the curds develop at different rates, you must go through the field every 2 or 3 days to tie each plant when the curd begins to show through the small central leaves.

You may want to use twine of a different color each day. In this way, you can tell that heads tied with a certain color will be ready for harvest on approximately the same date.

Broccoli does not need to be blanched.

## **HARVESTING AND PACKING**

### **Cauliflower**

If the weather is warm, heads may mature in as little as 3 to 5 days after blanching. In cooler weather, it may



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Figure 2.—Blanching cauliflower to protect the curd.

take as long as 2 weeks. The appearance of the curd is the best guide.

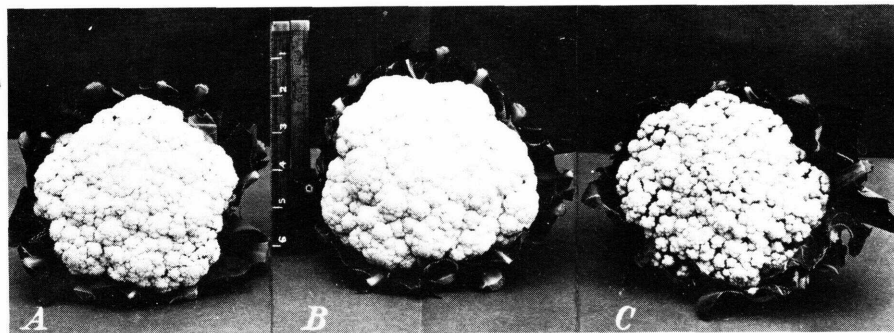
Mature heads are fully developed, compact, and clear white. Discolored or overmatured, open heads are not marketable. About 6 inches is the best size at harvest (fig. 3). However, unless the plants are large and very vigorous, delaying your harvest won't make small heads grow larger and may result in overmaturity.

Untie and examine a few heads each day to see that they do not overmature. It is better to harvest a little early than too late. You may sacrifice a little in size by cutting early, but you will avoid the quick loss of quality which occurs after the curds mature.

Use a large knife to cut the heads from the plants. Leave one or more sets of leaves attached to protect the curds.

Large producers usually haul cut heads to a central packing shed, where they grade, trim, precool, and pack them. Sometimes, heads are packed in the field.

In California and sometimes in the East, heads are trimmed closely,



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Figure 3.—Head of cauliflower in center is fully developed and at proper stage for harvest. Head on left is slightly overripe but still marketable. Head on right is too ripe to be marketable.

wrapped in perforated film, and packed in cartons. The film must be perforated to prevent off-colors and off-flavors after the cauliflower is cooked.

In the East, at least half of the cauliflower crop is packaged in wire-bound crates. If crates are used, allow a few leaves to remain attached, and cut them off just above the head. Leave a jacket of stalks and part of the leaf blades to protect the head.

Cool cauliflower promptly after harvest and keep it refrigerated during shipping and marketing.

## Broccoli

Cut broccoli with 8 to 10 inches of stem, before the flower heads open enough to show yellow, as shown in figure 1, page 7. When mature, the central heads are usually 3 to 6 inches across. Overmaturity causes woodiness in the outer stems and lowers market value.

You can sometimes get a second harvest of side shoots that continue to develop after the central head is cut. The side shoots measure 1 to 3 inches across. These small heads are very good for freezing.

Tie the cut broccoli in bunches, like asparagus, and pack it in crates, hampers, or wax-impregnated cartons. Side heads may be bunched separately or combined with central heads that mature at the same time, but combining them with the larger heads will reduce market value of the bunches.

Broccoli is very perishable. It should be cooled promptly after harvest and kept cool during shipping and marketing. Long-distance shipments need package ice and top ice.

## CONTROLLING INSECTS

### Caterpillars

Several species of caterpillars attack cauliflower and broccoli. They injure the plants by eating holes in the leaves, by destroying the growing buds, and by tunneling into the heads of older plants. The most destructive and hardest to control is the cabbage looper (fig. 4). You can recognize it by the way it doubles up (loops) when it crawls or is disturbed.

The cabbage looper, the imported cabbageworm, and the diamondback moth are predominately green. The cabbage webworm, the cross-striped cabbage-worm, the corn earworm, and climbing cutworms are brown, black, or gray, and sometimes have stripes. All are immature stages of moths or butterflies. They are 1/3 to 2 inches long when full grown.

The cabbage looper can usually be controlled with *Bacillus thuringiensis* methomyl, and methamidophos (monitor ®). Caterpillars or worms can usually be controlled with the following pesticides: azinphosmethyl; endosulfan; endosulfan and parathion; malathion; methomyl; methamidophos; naled; parathion; or *Bacillus thuringiensis*. Follow the directions on the label for rates and method of application for all pesticides.

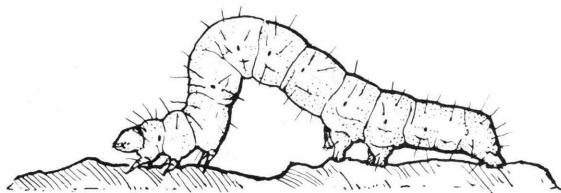
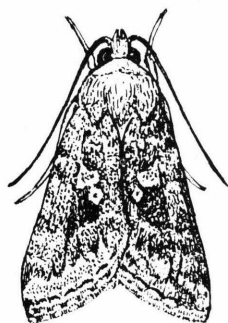
### Aphids

Aphids are tiny, soft-bodied insects that suck plant juices. Infested leaves

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<sup>1</sup>Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.





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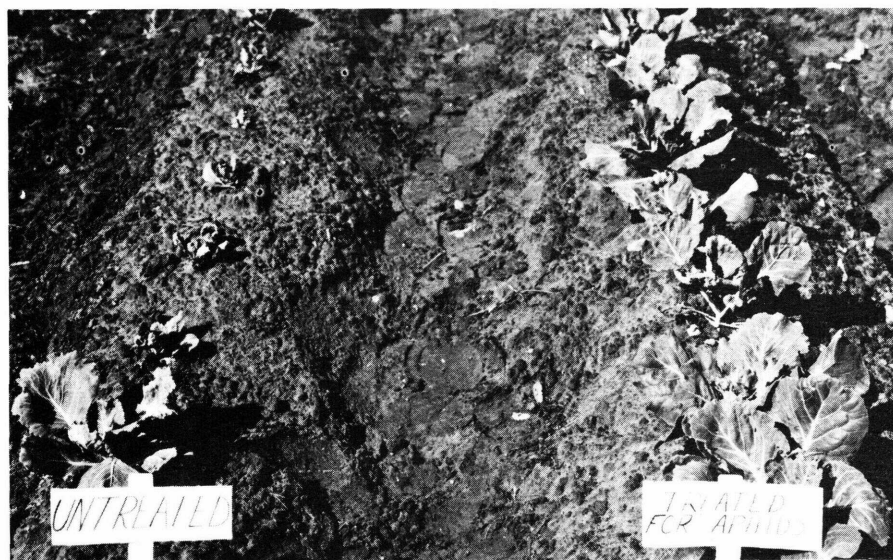
Figure 4.—Adult and larva on the cabbage looper.

crumble and curl around the aphids, making them difficult to reach with insecticides (fig. 5). The cabbage aphid is the most destructive aphid pest of cauliflower and broccoli. It is grayish green, about one-sixteenth inch long, and has a waxy, powdery covering on its body. Aphids can usually be controlled with azinphosmethyl; demeton; diazinon; dimethoate; disulfoton; malathion;

methamidophos; mevinphos; naled; or parathion.

### Cabbage maggots

Cabbage maggots are larvae of small flies that resemble houseflies. The flies lay eggs around plant roots soon after they are set. When the maggots hatch, they chew the stems and bore into the large roots and the



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Figure 5.—Cabbage plants showing damage by cabbage aphids to plants on left.

lower part of the stalks. Root maggots can usually be controlled with azinphosmethyl or diazinon. Follow the directions on the label for rates and method of application.

## CONTROLLING DISEASES

The most serious cauliflower and broccoli diseases are mosaic, black rot, blackleg, clubroot, damping-off, leafspot, powdery mildew, and downy mildew.

### Disease-free seed

Organisms that cause blackleg and black rot are sometimes found in cauliflower and broccoli seed grown east of the Rocky Mountains. Most of the seed is grown on the Pacific coast, where it is seldom affected by these diseases. If you cannot be sure of the origin of your seed, partially protect against blackleg and black rot with a hot water treatment.

Put the seed in very loose muslin bags and place bags in water at constant temperature of 122° F for 30 minutes. This will reduce germination in old or weak seed; run a test batch first to make sure your seed will stand the treatment. Dusting seed with a seed protectant such as captan helps protect seedlings, but it is not a substitute for the hot water treatment. If practicable, use seed from the Pacific coast.

*Copper dusts should not be used on broccoli seed.*

Fungicides used to control some of the more important fungus diseases are pentachloronitrobenzene (PCNB), for clubroot; ferbam or maneb, for downy mildew and leafspot; and sulfur, for powdery mildew.

## Seedbed sanitation

Do not use the same soil repeatedly in coldframes or seedbeds, because most disease germs live over in the soil. Rotate outdoor seedbeds and treat soil in hotbeds or coldframes by steam sterilization or chemical fumigation, such as methyl bromide.

Mosaic viruses live over in plants, including weeds in the cabbage family, and can be carried to seedbeds by aphids. Do not place seedbeds near weedy borders; keep coldframes free of weeds.

Clean up cabbage, cauliflower, and broccoli remains promptly where ring spot is severe, as in some Pacific coast areas. Spores that are discharged by these remains can be carried by air currents for long distances.

You will find more information on controlling pests and diseases of cauliflower and broccoli in Agriculture Information Bulletin No. 380, "Insects and Diseases of Vegetables in the Home Garden," and Farmers' Bulletin No. 2148, "Aphids on Leafy Vegetables: How to Control Them."

Single copies of these publications may be obtained free from the Office of Communication, U.S. Department of Agriculture, Washington, D.C. 20250. Send your request in on a post card and be sure to include your return address and ZIP Code.

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## CAUTION

Methyl bromide is highly toxic and may cause death if swallowed, inhaled, or absorbed through the skin.

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## USE OF PESTICIDES

This publication is intended for nationwide distribution. Pesticides are registered by the Environmental Protection Agency (EPA) for countrywide use unless otherwise indicated on the label.

The use of pesticides is governed by the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended. This act is administered by EPA. According to the provisions of the act "It shall be unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling." (Section 12(a)(2)(G))

EPA has interpreted this section of the act to require that the intended use of the pesticide must be on the label of the pesticide being used or covered by a Pesticide Enforcement Policy Statement (PEPS) issued by EPA.

The optimum use of pesticides, both as to rate and frequency, may vary in different sections of the country. Users of this publication may also wish to consult their Cooperative Extension Service, State agricultural experiment stations, or county exten-

sion agents for information applicable to their localities.

The pesticides mentioned in this publication are available in several different formulations that contain varying amounts of active ingredient. Because of this difference in active ingredient, the rates given in this publication refer to the amount of active ingredient, unless otherwise indicated in the publication. Users are reminded to convert the rate in the publications to the strength of the pesticide actually being used. For example, 1 pound of active ingredient equals 2 pounds of a 50 percent formulation.

The user is cautioned to read and follow all directions and precautions given on the label of the pesticide formulation being used.

Federal and State regulations require registration numbers on all pesticide containers. Use only pesticides that carry one of these registration numbers.

USDA publications that contain suggestions for the use of pesticides are normally revised at 2-year intervals. If your copy is more than 2 years old, contact your Cooperative Extension Service to determine the latest pesticide recommendations.





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*Use Pesticides Safely*  
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE

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